

Applications of Stochastic Dominance in Agriculture: Lecture XXXI

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1 Selecting Marketing Instruments

2 Nonparametric Kernels

- Moss, Charles B., Stephen A. Ford, and Mario Castejon. 1991. Effect of Debt Position on the Choice of Marketing Strategies for Florida Orange Growers. *Southern Journal of Agricultural Economics* 23(2): 103-112.
- The risk of a firm can be decomposed into business risk and financial risk.
 - Business risk is the risk inherent in the production/business environment.
 - Financial risk results from the leverage (debt) decisions based on that business environment.

DuPont Expansion

- Collins (1985) demonstrated this decomposition using a DuPont expansion.

$$R_E = \frac{\left(\frac{r_P}{A} + i\right) - \delta K}{1 - \delta} \quad (1)$$

- Following this specification

$$R_A = \frac{r_P}{A} + i \Rightarrow \sigma_A^2 \quad (2)$$

- The expected rate of return on equity and the variance of the rate of return on equity can be derived as

$$\mu_E = \frac{\mu_A - \delta K}{1 - \delta}, \sigma_E^2 = \frac{\sigma_A^2}{(1 - \delta)^2} \quad (3)$$

Capital Structure

- Following Modigliani-Miller the value of assets is independent of the capital structure.
- In agriculture, such arbitrage is typically not possible (i.e., there are very few publicly traded firms.
- Literature following Collins (1985) allows for endogeneity, but holds the cost of debt constant.
- This study (Moss, Ford, and Castejon) allows the cost of capital to be stochastic

$$R_t^i = P_t^i Y_t - V - Dr_t \quad (4)$$

- This study then applies the above definition to derive a series of returns for oranges marketing their output as FCOJ using cash markets, futures, and participation.

Table : Second Degree Stochastic Dominance - December

Debt Position	Cash	Participation	Hedge
0	X		
30	X		
40	X		
50	X		
60	X		

Table : Second Degree Stochastic Dominance - February

Debt Position	Cash	Participation	Hedge
0	X	X	
30	X	X	
40	X	X	
50	X	X	
60	X	X	

Table : Second Degree Stochastic Dominance - April

Debt Position	Cash	Participation	Hedge
0		X	
30		X	
40		X	
50		X	
60		X	

Table : $r(x) = [0.000002, 0.000003]$

Debt Position	Cash	Participation	Hedge
0	X	X	
30		X	
40		X	
50		X	
60		X	

Table : $r(x) = [0.000003, 0.000004]$

Debt Position	Cash	Participation	Hedge
0	X		
30	X	X	
40	X	X	
50		X	
60		X	

Nonparametric Kernels

- Moss, Charles B. and Grigorios Livanis. 2009. Implementation of Stochastic Dominance: A Nonparametric Kernel Approach. *Applied Economics Letters* 16(15), 1517-22.
- First degree stochastic dominance

$$\begin{aligned}\Delta &= E_F U(x) - E_G U(x) = \int_a^b [f(x) - g(x)] U(x) dx \geq 0 \\ \Rightarrow \tilde{\Delta}_1 &= G(x) - F(x) \geq 0 \forall x \\ \tilde{\Delta}_1^i &= \inf_x G(x) - F(x) \\ \tilde{\Delta}_1^s &= \sup_x G(x) - F(x)\end{aligned}\tag{5}$$

$$\begin{aligned}\Delta_2 &= \left(U'(x) \int_a^b [G(x) - F(x)] \right) \Big|_a^b + \\ &\int_a^b \left(-U''(x) \int_a^x [G(z) - F(z)] dz \right) dx \\ \tilde{\Delta}_2 &= \int_b^x [G(z) - F(z)] dz \geq 0 \forall x \\ \tilde{\Delta}_2^i &= \inf_x \int_a^x [G(z) - F(z)] dz \\ \tilde{\Delta}_2^s &= \sum_x \int_a^x [G(z) - F(z)] dz\end{aligned}\tag{6}$$

- Discrete cumulative density function

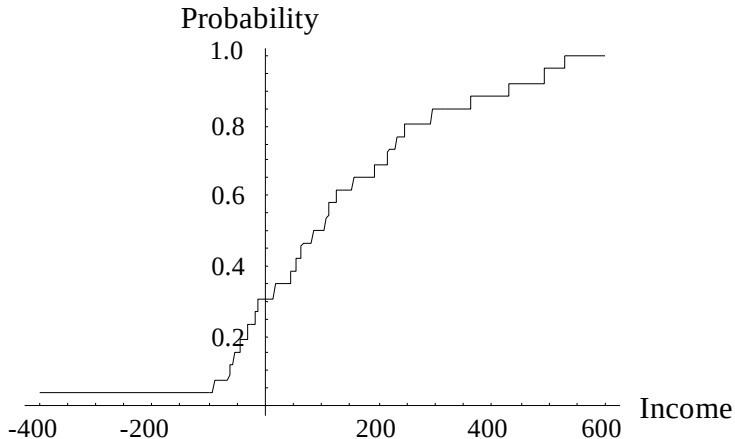
$$F(x) = \frac{N^* [y \leq x]}{N} \quad (7)$$

- Kernel specification of the nonparametric regression

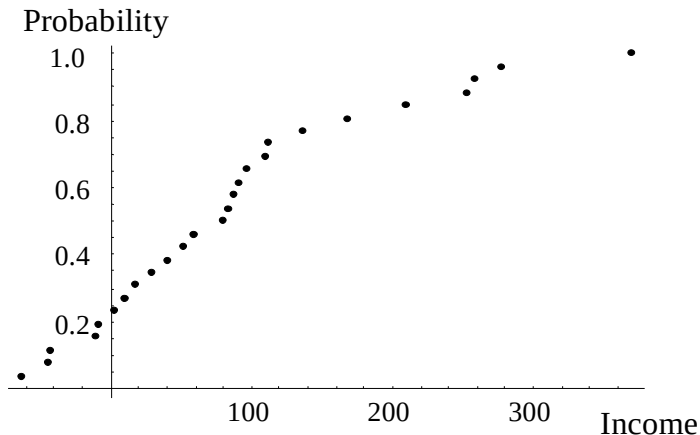
$$\hat{y}_i = \sum_{j=1}^N k(x_j, \hat{x}_i) y_j \quad (8)$$

$$k(x_j, \hat{x}_i) = \frac{1}{\sqrt{2\pi}} \exp \left[-\delta (x_j - \hat{x}_i)^2 \right]$$

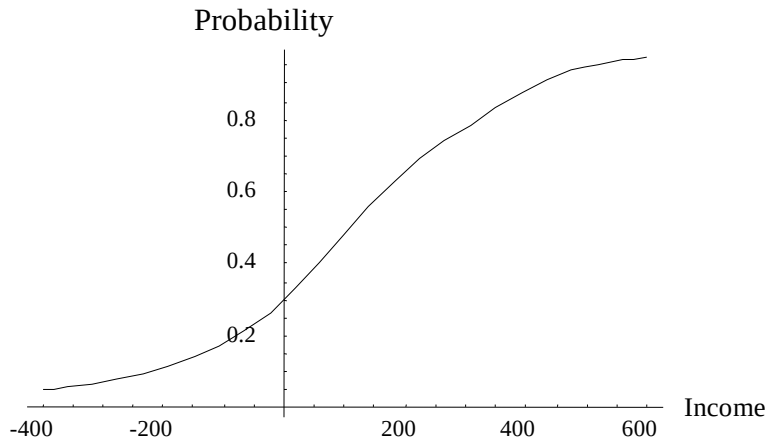
Discrete Cumulative Density Function



Nonparametric Regression - 1



Nonparametric Regression - 2



Nonparametric Regression - 3, the Probability Density Function

